

ASIAN SEED

THE OFFICIAL PUBLICATION OF THE ASIA & PACIFIC SEED ASSOCIATION



US Study Tour
APSA group tours
Cali veg farms,
facilities



ASC 2016
Incheon welcomes
delegates to the 23rd
Asian Seed Congress



PVP IP Policing
Anti-infringement
bureau looking
after investments



Seed for Thought
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ASIAN SEED

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Building a Future Together



Photo by John Clewley

It seems like it was just yesterday that I began my two-year tenure as APSA's President, the first in the association's history. A lot has happened and there have been many changes, but I think we can all see that progress is being made.

I am pleased to let you know that APSA has been active this year. The Office Bearers and EC members have supported the Secretariat in dealing with changes that occurred in 2015, and in addition to this we have hired a new Director, the hardworking Heidi Gallant, who has been integrated into the Secretariat team.

APSA has organised and attended a wide range of important events over the past year. Director Heidi Gallant and Technical Affairs Director Dr. NK Dadlani have just returned from a vegetable seed industry study tour to the United States (see page 9), and will have participated in a hybrid rice study tour to India by the time you read this message! APSA

plans to organise further study tours in 2017 based on the requirements and needs of its members.

The follow-up meeting to the Phytosanitary Workshop, held in Bangkok in 2016, was well attended. Some 30 experts and plant protection officers were able to attend the meeting in early September of this year, representing another step forward in our efforts to harmonise phytosanitary regulations.

The Asian Seed Congress 2016 in Incheon is drawing closer and I am happy to report that booths, private rooms and all trading tables have been taken by APSA members. Indeed, preparations for Congress are in full swing and we have prepared a packed programme of events, meetings and tours that will appeal to everyone (see pages 26 and 27 for the full programme and floor plan).

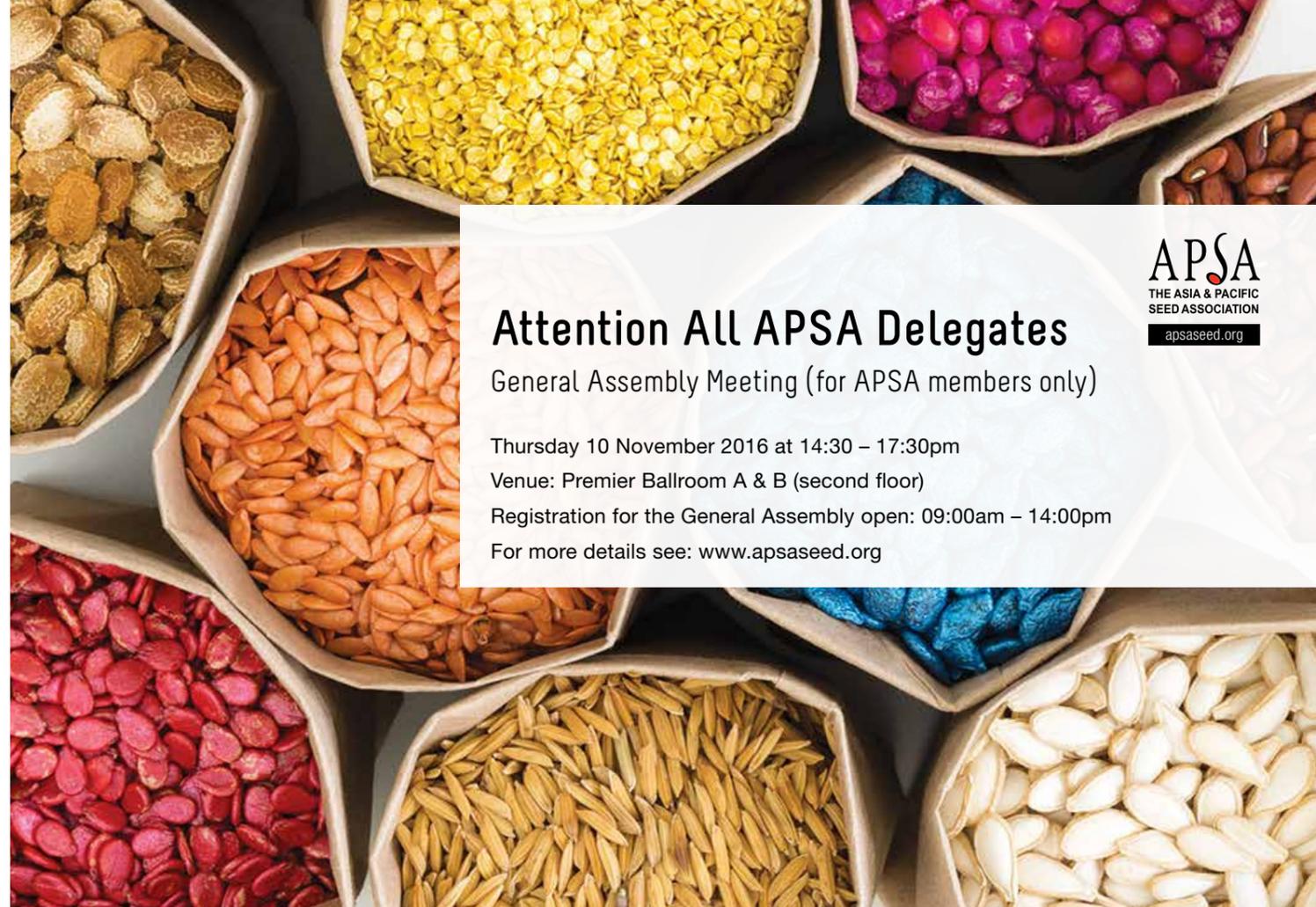
As usual, Congress begins with the Pre-Congress Workshop, which

this year focuses on the important topic of Plant Variety Protection. With places limited to 120 delegates, it is important that you register quickly to guarantee a place for yourself (see asianseedcongress.com for further details). In addition, Dr. Dadlani has organised a comprehensive programme of key topics for all of APSA's Standing Committees and Special Interest Groups (see programme for more details).

At this year's General Assembly Meeting (GAM) on Thursday, 10 November, there are new positions and re-election opportunities for delegates to consider, discuss and vote on. There are eight seats up for election: six seats for seed enterprises and government seed agencies; one seat for a seed association; and one seat for an associate member (i.e., from outside APSA's region). Details of the nominated members are available on the APSA website. The Director will inform all members by Tuesday, 11 October (30 days prior to the GAM). Please make sure you attend the GAM so that you can participate in the association's future.

Finally, I would like to thank all of you for your support and encouragement over the past two years. It has been hard work, but with the association moving in the right direction, I am confident that APSA will grow and prosper.

Enjoy your Asian Seed Congress! 🌱



Attention All APSA Delegates

General Assembly Meeting (for APSA members only)

Thursday 10 November 2016 at 14:30 – 17:30pm

Venue: Premier Ballroom A & B (second floor)

Registration for the General Assembly open: 09:00am – 14:00pm

For more details see: www.apsaseed.org




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Welcome to Congress!

Welcome to Congress! Your APSA secretariat and I have been busy bees making sure all is in order for our delegates. This year's congress is our biggest yet and we are delighted to welcome you and your colleagues to this exciting event. You will find our team around Congress in blue and yellow APSA shirts as you enjoy meeting old friends, making business deals and attending speaker presentations. They are more than happy to assist you with your needs so please do not hesitate to introduce yourself to them. Since Congress is one of the few opportunities we have to meet you all face to face, we would love to get to know everyone.

Aside from Congress, there is plenty going on in the secretariat office as always. Dr. Dadlani and I brought a study tour to the USA in August, more details of which can be found on pages 9-11 of this issue..

At the end of August, a delegation from APSA visited Myanmar for a workshop planned by the Vegetable Sector Acceleration Task Force, which aimed to facilitate the birth of the National Seed Association of Myanmar. Joining the event for APSA were myself; Dr. Narendra Dadlani, APSA's Director of Technical Affairs; Jack Metzelaar, Treasurer of APSA's Executive Committee; Mary Ann Sayoc, past President of APSA and President of the Philippines Seed Industry Association; Madoka Koshibe, past President of APSA and Director of International Relations with the Japan Seed Trade Association; and Vaibhav Kashikar, member of APSA's Executive Committee and of the Governing Council for the National Seed Association of India.

There were over a hundred delegates in attendance at the event, including the Myanmar Minister of Agriculture,

Livestock and Irrigation, His Excellency Dr. Aung Thu, and the Kingdom of the Netherlands Ambassador to Myanmar, His Excellency Wouter Jurgens, who attended a presentation – which was prepared by APSA Executive Committee member, Anke Van den Hurk, and presented by myself – on the considerations to be discussed for the draft constitution of the new association.

In addition to a presentation about the National Seed Association of Myanmar, other presentations made included one by Joep van den Broek of Wageningen University, entitled "Road Map for Myanmar Seed Sector Development", as well as one by Clive Murray of the Syngenta Foundation, entitled "Proposed Business Models for Myanmar Seed Industry".

Following the morning of presentations, our delegation sat down with 25 seed industry and government stakeholders to nail down the elements they most wanted expressed in the governing document for the National Seed

Association of Myanmar. Having the input of our APSA delegation, as experienced board directors from Seed Associations in the region, was a valuable addition to the discussion, and the local parties appreciated the chance to learn from their experience. It was suggested that the next step should be to convene an assembly of potential members of the National Seed Association of Myanmar, and, from this group, select the first board of directors for the association. These individuals would become the founding members of the association and take responsibility for the collection of the first membership dues, hiring the first Manager of the association and registering the first constitution with the local authorities.

Following the visit to Myanmar, the Office Bearers of APSA visited Bangkok for their quarterly meeting on 1 and 2 September. Here they handled many of the small details that happen behind the scenes of the organisation and received updates on the management of the team who make things happen at APSA.



Photo by John Clewley



The delegation at the Second Expert Consultation on Phytosanitary Collaborations in Bangkok on 5 and 6 September.

For the second day of the meetings, the secretariat hosted the Office Bearers at their office at Kasetsart University.

On 5 and 6 September, APSA's Trade and Marketing Standing Committee hosted the Second Expert Consultation on Phytosanitary Collaborations in the Asia and Pacific Region. National Plant Protection Officers from China, Japan, Vietnam, Thailand, Malaysia, New Zealand, the Philippines, Laos and Pakistan joined us with delegates from industry, advisors from the International Seed Federation, the American Seed Trade Association,

the Centre for Agriculture and Biosciences International, and the ASEAN Secretariat. Takeaways from this meeting will be discussed in depth in our next issue, but I personally feel this meeting is the starting point for industry to be consulted and invited when phytosanitary measures are being discussed and implemented with relation to seeds. This meeting was our opportunity to express to these officials that seed enterprises are invested as much in the movement of quality, safe seed across borders as the NPPOs are, and that we are ready and willing to commit our resources to working

together to achieve this aim. This meeting was made possible through the sponsorship of Crop Life Asia, who also assisted APSA in planning and facilitating the meeting.

At the end of September, APSA brought a delegation to India to learn about hybrid rice. This delegation was mostly made up of Chinese nationals, although we did have one Filipino delegate join us. The tour was led by APSA's Director of Technical Affairs, Dr. Narendra Dadlani, and our China Liaison Officer, Xiaofeng Li. Our new Communication Officer, Steven Layne, and myself joined the tour for the first five days to partake in meetings with the seed industry members, allowing us the opportunity to meet important stakeholders for APSA.

Finally, as mentioned in the previous paragraph, APSA has a new team member, Mr. Steven Layne. He joined APSA on 12 September and we are keeping him busy with improvements to our APSA communications policy. Please expect to be hearing from us much more frequently and be sure to follow us on LinkedIn, Twitter, Facebook and Google Plus for up-to-date information on our activities and those of the National Seed Associations throughout the Asia Pacific region. 🐝

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From left, H.E Dr. Aung Thu, Dr. N.K. Dadlani and U Tin Htut Oo, Chairman of Myanmar's Vegetable Sector Acceleration Taskforce (VSAT)



This illustration is Shin Yun-bok's 'Dan-opungjeong' which is Korean genre painting in the second half of the 18th Century.

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US Study Tour

The Asia and Pacific Seed Association (APSA) took a delegation of members from China, India, Pakistan, Japan, Korea and Myanmar to San Francisco, California, to explore the seed industry in the USA.

The delegation was led by Heidi Gallant, Executive Director at APSA, and Dr. Dadlani, APSA's Technical Director. The majority of the programme was arranged by Michelle Klieger, Director of International Programs and Policy at the American Seed Trade Association, and also joining the tour was Bethany Shively, Director of Communications at the American Seed Trade Association (ASTA).

The delegation arrived in the USA on Sunday, 14 August and the tour kicked off on 15 August with a visit to Rijk Zwaan in Salinas. Following a presentation from Rick Falconer, Managing Director (USA), the delegation headed to the field to see the trials for spinach, lettuce

and cabbage. Their experts even let the group try the new varieties they are currently developing for disease resistance and taste in the US market.

The delegation then set off to Sakata, where a field day was in progress. Plant breeders showed the group Sakata's specialty, broccoli, and the group also had the chance to see special varieties of beets and cabbage, along with other crops on display.

Day two saw the group visit Incotec and Seed Dynamics. Both of these companies focus on technology applied to improve seed germination, enhancing the planting value and overall seed yield, with each company having its own specialties and clients specific to their respective operations.

Capping off day two, the group travelled to Davis California, and, on the way, visited Golden Valley Seed in Salida, CA. The delegation headed straight to the field and

were offered samples of wonderful varieties of melon fresh from the Golden Valley vine while they toured the rows. Nassif Burkuch showed the group what makes Golden Valley special while everyone enjoyed the California sunshine.

On day three the group visited HM Clause and, in the breezy morning, toured the melon, pepper and tomato fields while experts explained what HM is working on. The group was allowed to take just a few pictures, which was very gracious. Later that morning, the group visited HM's Fruit Quality and Cell Biology & Pathology labs. No pictures were allowed there, but the group got the chance to see the facilities that make HM products unique.

That afternoon, the group sat down with Tom Moore, West Coast Small Seed Production Manager at HM, for a discussion about ASTA and phytosanitary developments in the US. Tom also joined APSA



for the APSA-organised Second Phytosanitary Expert Consultation held in Bangkok on 5 and 6 September, representing ASTA's work on phytosanitary measures in North America.

On day four the group visited Monsanto Seminis™ for another early morning field visit to watermelon and pepper trials, while also getting to see the garden Monsanto had developed for the All America Selections. The delegation toured the beautiful garden, tasting many varieties of cherry tomato and viewing some interesting varieties of okra. The tour participants were also briefed about the working of Monsanto's Seed Health and High Throughput Genotyping Laboratories.

That afternoon, the group travelled back to the HM Clause cucumber seed field to see how machines harvest cucumber seeds. The large harvester scoops up the cucumbers as it drives along the rows of plants and then passes them up a conveyor belt into the machine, where they are bashed about inside. The seeds are collected and the leftover cucumber shells are spit out by a large cylinder on the back of the device. The group then viewed the seeds before they were sent to be washed and dried. It was an interesting experience for those who are currently harvesting wet seeds by hand.

On the fifth and final day the group visited the University of California, Davis, receiving presentations from the Seed Biotechnology Centre where they were given information on seed business and breeding courses offered by the university, both in California and abroad. The group then enjoyed an overview of innovative technology being developed at UC Davis from Britta Hansen of the Horticulture Innovation Lab.

The week was brought to a close at the home and farm of AgInnovations representative Peter Marks. The group toured the vineyard and cherry orchard, tasted the wines made on site, got a lesson in winemaking, and were treated to a lovely barbeque while sitting outside in the lovely California fresh air with Peter and his wife.

The entire group felt this was a wonderful way to cap off an informative, educational and fun experience.

APSA would like to take this opportunity to thank our itinerary organiser, Michelle Kleiger of ASTA, without whom this trip would not have been possible. APSA would also like to thank all of the organisations who hosted the delegation on this visit for their time and consideration. APSA is very grateful for the collaboration and effort put forth by our partners, stakeholders, hosts and members for these efforts, and plans to provide many more tours in the future, further benefiting members and providing the opportunity to share experiences and broaden our networks. 🙌



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ASIAN SEED CONGRESS

The focus of the global seed industry returns to South Korea this year as the Asian Seed Congress makes its second appearance in the country, following ASC 2004 in Seoul. This time, Congress has moved to Incheon, South Korea's first international port and a driving force behind the country's rapid industrialisation and development.

South Korea is one of the economic powerhouses of East Asia and is the most developed country on the Human Development Index from this region. More than 92% of the population live a distinctive urban lifestyle, with many people residing in high-rise blocks concentrated in the Seoul Capital Area, which boasts a population of 25 million residents.

Known as one of the four 'Asian Tiger' economies (along with Hong Kong, Singapore and Taiwan), the country's economy has motored along at an annual average of 10% growth for more than 30 years (gaining the local nickname of the 'Miracle of the Han River'), all while transforming itself into the world's fifth largest exporter and seventh largest importer.

It also has the largest budget surplus and highest credit rating of any East Asian country.

In 1987, South Korea became a multi-party democracy with universal suffrage. It is known for its comprehensive healthcare system, excellent education programme (South Korean students often top mathematics tests worldwide), governmental transparency, and freedom of religion and fundamental human rights. Additionally, South Korea also boasts the third highest life expectancy in the world.

South Korea is home to well known global brands like leading smartphone maker Samsung and carmaker Hyundai-Kia, as well as electronics maker LG. It has garnered a reputation for innovation and research; for instance, Bloomberg media named South Korea as the world's most innovative country, ranking it first in business R&D intensity and patents filed per capita. It has the fastest internet and highest smartphone ownership, and was the first country to make the transition to high-speed internet and to implement mobile TV broadcasts to cellphones.

Deep Historical Roots

Evidence of early human activity in Korea goes back to the discovery of pottery from about 8,000 BC. By the 1st century BC, three kingdoms existed in the Korean peninsular with one of them being the root of the name Korea, which was derived from 'Goryeo' and refers to the ancient kingdom of Goguryeo (as named by visiting Persian merchants).

After 1945, the country was named the Republic of Korea. While the aim of the 1943 Cairo Declaration was to create a unified Korea, the growing Cold War between the USA and the Soviet Union in 1948 led to the establishment of two separate governments and ideologies: North Korea and South Korea.

Since the early 1960s, South Korea has posted high economic growth rates (see infographics on the following page) and is now recognised for its high performing mixed economy, due in part to South Korea being the most industrialised member country in the Organization for Economic Cooperation and Development or OECD. To give an indication of South Korea's broad-based economic power, consider the fact that South Korea was one of the very few

developed countries to avoid a recession during the 1997 global financial crisis. It is also worth noting that South Korea has a technologically advanced, integrated transportation network which consists of high-speed railways, bus routes, ferry services and air-routes that criss-cross the country.

South Korea's seed industry has developed in tandem with the country's high growth economy. It is a major seed importer: during 2009 to 2014, South Korea imported \$116 million worth of vegetable seeds (67%) and fodder crop seeds (15%). High costs and a poor climate for seed production mean that South Korea gets more than 80% of its seeds from overseas these days. The Netherlands, China and Japan provide most of the vegetables seeds, while the USA has the largest market share for imported fodder seeds, cereals and maize. Although South Korea's seed exports are modest compared to those of China and Japan, its seed exports grew by an impressive 73% between 2009 and 2014 to \$26 million (for more details, see "Seed Trade In Asia, Part 1" by GNIS in vol. 22 issue no. 1 of Asian Seed).

REPUBLIC OF KOREA



The Korean flag is called "Taegeukgi" in Korean. Its design symbolises the principles of the yin and yang in Oriental philosophy.



South Korea is a G-20 major economy – a developed, high-income country. The country hosted the fifth G-20 summit in Seoul in 2010.



The Republic of Korea (unofficially, South Korea) was first established prior to 194 BC (during the country's first dynasty). It has a population of 50.4 million people and a total area of 100,210 km².



The South Korean Won or the Korean Republic Won (KRW) is the official currency of South Korea. Adorned with pictures of Korean scholars and kings, the won currently sits at an exchange rate of 1,122 KRW to 1 USD and has an inflation rate of 0.7%.



The *Hibiscus syriacus*, also known as the Korean Rose (or the *mugunghwa* in Korean), is the national flower of Korea and appears in national emblems. The *mugunghwa* blossoms from July to October and covers the entire country each year.



The GDP from agriculture in South Korea has averaged \$4.3 billion from 1960 up until 2016, reaching an all-time high of \$6.9 billion in the first quarter of 2015. The second quarter of 2016 last recorded South Korea's GDP from agriculture at \$6.3 billion.

Statistics on South Korea

\$1.96 TRILLION

GDP (estimated total for 2016)

\$34,549

GDP/per capita

3.2%

annual GDP growth rate

84.3

internet users per 100 people (last recorded in 2014)

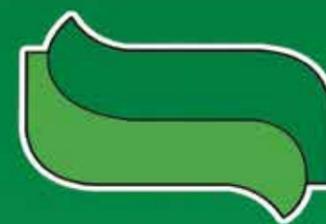
97.9%

literacy rate

92%

population living in urban areas

Sources: OECD, World Bank, IMF, KOSA, Bank of Korea, www.tradingeconomics.com/south-korea/gdp-from-agriculture, <https://data.oecd.org/korea.htm>



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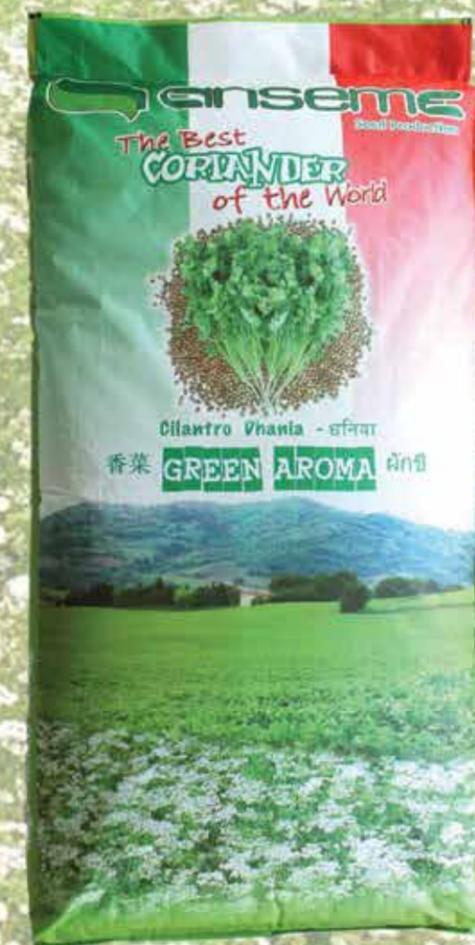
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APSA'S Q&A WITH KOSA'S PRESIDENT LEE



Photo by John Clewley

Three KOSA officers (left to right): Vice President Sang-Guen Kim, President Jong Woo Lee and General Manager Hyun-Ho Shin

APSA: Describe KOSA and the work it does.

Lee: The Korean Seed Association (KOSA), founded in 1965, promotes stable agricultural production by developing high quality seeds and helps facilitate regulatory procedures related to the seed trade and seed distribution in Korea.

We maintain close relationships with institutions, as well as government agencies, to represent the interests of KOSA members and to try to increase benefits and harmony between our members. We have 59 members now and we organise a General Assembly and a CEO forum twice a year to communicate with them. We also hold forums for experts in order to help solve pending issues and provide alternatives.

What is the current situation of the seed industry?

The Korean seed market is estimated at \$400 million, or about 1.1% of the world seed market. The field crop market is worth about \$170 million,

vegetable crop, \$1.5 billion, and horticulture, \$110 million. However, the domestic market may have peaked because seed demand has been shrinking continuously due to slowing consumption, a reduction in cultivation acreage, increasing agricultural imports and the growth of the seedling industry.

A person/company wanting to operate a seed business must be equipped with facilities as prescribed by the Seed Industry Law, must register his/her business with the Mayor or Provincial Governor of the town or province in which the seed business is located, and they must have one or more seed quality managers.

The number of seed businesses registered is 1,368, including the following segments: 60 companies in field crops, 411 in fruit, 227 in vegetables, 213 in horticulture and 132 in mushrooms. If importers were included, the number of companies operating in the seed industry would certainly rise.

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Regarding markets, what seed is produced for domestic use and what seed is exported?

Self-sufficiency in field crop and vegetable seed varieties is likely to be high, but fruit tree and horticultural varieties are highly dependent on imported varieties.

Field crops such as rice, barley, soybean, corn and potato have been developed and supplied by the public sector, while vegetable and horticultural variety development and distribution have been led by the private sector.

In 2015, seed export sales reached \$47 million, mainly comprised of vegetable seeds. The principal vegetable seed exports currently are hot pepper, radish, Chinese cabbage and cucumber. Fruit trees, horticulture, grass and cover crops (and also onions and sweet peppers) are highly dependent on imports.

Our seed imports and exports have increased significantly, however, in the case of imported seeds, overseas seed production is the main source.

What are the major issues and challenges for the seed sector?

The domestic market is stagnating and there are so many small enterprises. In terms of global trade liberalisation, South Korea has promoted free trade agreements. Consequently, agricultural production imports are increasing and agricultural consumption is declining as the population shrinks and consumption patterns change. Therefore the area used for cultivation

has shrunk and this has decreased demand for seed. In addition, because companies are entering into a limited domestic market, many of them are quite small; there are currently 227 companies registered as vegetable seed businesses.

Outwardly, the challenges that the Korean seed industry faces are similar to those faced by APSA's member countries in the world seed market – food security, climate change, mergers and acquisitions in the global seed market, international regulations like ABS, quarantines, and Plant Variety Protection.

KOSA assists in the development of high quality seed varieties on the basis of our members' excellent breeding technologies, and also tries to create good seed distribution. We cooperate with international organisations like APSA, ISF and so on, as well as relevant local agencies such as KSVS (Korea Seed & Variety Service – see next story) and MAFRA (the Ministry of Agriculture, Food and Rural Affairs) to find solutions for these challenges.

What opportunities are there for foreign companies (and APSA members) in the Korean seed market?

Monsanto Korea, Syngenta Korea, Bayer Crop Science, Takii Korea and Sakata Korea have all entered the Korean market, and there are opportunities for many companies to work across multiple sectors, from breeding and production to marketing and distribution. Some executives from these companies also serve on the executive board of KOSA in order to facilitate the development of the seed industry.

KOREA SEED & VARIETY SERVICE

At the Asian Seed Conference in Goa, India, back in November 2015, the Director General of the Korea Seed & Variety Service (KSVS), Byeong Seok Oh, was part of the signing ceremony for ASC 2016, being held here in Incheon. He co-led a Korean delegation with co-host KOSA (the Korean Seed Association) to meet members of APSA's Executive Committee and to sign the contract for ASC 2016.

At the time, he said that the broad aim of participating in an Asian Seed Congress with APSA was to expand the export of Korean seeds through international market entry of the Korean seed industry. He added that he believed the Asian Seed Congress would help promote the excellence of Korean seeds to all the international stakeholders of the global seed industry.

KSVS is responsible for a range of specific tasks and projects related to the management of seeds in South Korea, including: the protection of plant varieties; ensuring legal protection for producers of new seeds; the establishment of a national variety list and Plant Variety Protection (PVP) of agricultural crops; ensuring stable and sustainable agricultural production; management and implementation of DUS and VCU testing; securing the production and supply of superior seeds for core agricultural crops, such as rice and barley; and undertaking seed inspection activities to prevent the illegal distribution of seeds.



Byeong Seok Oh, Director General of the Korea Seed & Variety Service (KSVS)

In a press release from the Ministry of Agriculture, Director General Oh said that 13 Korean seed companies attended ASC 2015 in Goa, India. He explained that for this year's congress, detailed background checks were made on the feasibility of holding a Congress in South Korea (the previous one held in South Korea was in 2004 in Seoul). Then discussions were held across the industry to exchange information and strengthen the cooperation between the private and public sectors.



Golden Seed Project

The Golden Seed Project (GSP) is part of the South Korean Government's drive to support the seed industry. The 'Golden Seeds' in the project title refers to "high-value-added seeds worth as much as gold", according to the project website; indeed, the website claims that coloured bell pepper seeds were actually more expensive than the price of gold! The GSP was established in 2012 with a total budget of KRW 490 billion (\$438 million) and is a strategic national R&D project for seeds based on collaboration between the Ministry of Agriculture, Food and Rural Affairs (MAFRA), the Ministry of Oceans and Fisheries (MOF), the Rural Development Administration (RDA) and the Korean Forest Service (KFS). The first part of the project, which has been running since its inception in 2012, will be completed at the end of 2016, with the Asian Seed Congress providing a platform for the Korean seed industry to actively showcase the Golden Seed Project to the global seed industry. The GSP will be implemented over a ten year period from 2012 to 2021 with the intent to develop strategic seeds for export.

The operations of the project were established within a specialised R&D facility, the Korea Institute of Planning & Evaluation for Technology in Food, Agriculture, Forestry and Fisheries, or IPET, which has been tasked with the project planning and management of the GSP. The GSP aims to develop more than 20 strategic export varieties by supporting five project groups, each of which are responsible for developing new varieties under global market domination and variety projection strategies (see below and diagram on page 20):

- Vegetable Seed Development Division (chili pepper, Chinese cabbage, radish, watermelon, bell pepper)
- Horticulture Seed Development Division (cabbage, onion, tomato, mushroom, lily, mandarin)
- Fisheries Development Division (flatfish, serranidae, abalone and porphyra)
- Staple Seed Development Division (rice, potato and maize)
- Breeding Stock Development Division (pigs and chickens)

CHIA TAI SEEDS CO., LTD.



Golden Seed Project

VISION

Powerhouse leading future agriculture, fishing, and livestock industries

GOALS

Global leader in the global seed industry
\$200 million in seed exports by 2020, \$3 billion in seed export by 2030

MAIN TARGETS

Seed development for dominating the global market	Seed development for strategic variety protection	Concert nationwide efforts	Enhance export capacities of the private sector	Advocate comprehensive support for R&D to boost exports
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INPUT

Total project cost over 10 years: KRW 491.1 billion
Government investment: KRW 3,985 billion
Private investment: KRW 926 billion (planned)

Utilise interdepartmental cooperation and previous research achievements

NAFRA MOF RDA KFS Private companies



Koregon grows the dream in the seeds.



Anseong Center



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GSP Strategy

- Concentrate nationwide capabilities through industry-academia-government cooperation.
- Develop seeds and increase export capacities through the leading role of private companies.
- Provide comprehensive support for strategic R&D projects to penetrate target export markets using the following:
 - Strategic items for dominating the global market: chili pepper, Chinese cabbage, radish, watermelon, flatfish, serranidae, abalone, rice, potato and maize.
 - Strategic items for variety protection: cabbage, onion, tomato, mushroom, lily, mandarin, bell pepper, porphyra, pigs and chickens.

Golden Seed Project website: www.gsp.re.kr

CONTACTS & SEED-RELATED LEGISLATION

Seed Industry Act (Act no. 5024, enacted 6 December 1995; amended up to Act no. 11, 704, dated 23 March 2013)

Definition: "The purpose of the Act is to develop [the] seed industry and to contribute to [the] stability of agriculture, forestry, and fishery by enacting provisions on protection of the breeder's rights, management of variety performance of major crops, seed production, certification, marketing, etc."

Full text of the Seed Industry Act available from World Intellectual Property Organization: www.wipo.int

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Korean Seed Export Cooperation

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Golden Seed Project

www.gsp.re.kr

Statutes of the Republic of Korea:

(includes relevant agricultural legislation)
http://elaw.klri.re.kr/eng_service/lawTotalSearchSogan.do?seq=7

To find news on South Korea

www.korea.net
(e.g., article on Korean IP related to seeds:
www.korea.net/NewsFocus/Policies/view?articleId=123790)

Rural Development Administration

www.rda.go.kr

Ministry of Science, ICT and Future Planning

<http://english.msip.go.kr>

National Science & Technology Commission

www.nstc.go.kr

Vegetable Seed Development Division

www.vegetable.or.kr

Korean Customs Service

<http://portal.customes.or.kr>

The Korean Society of Breeding Science

www.breeding.or.kr

National Academy of Agricultural Science

www.naas.go.kr

National Institute of Crop Science

www.nics.go.kr



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Fresh from the World Vegetable Center

AGREEMENT SIGNED FOR MUNGBEAN RESEARCH

The World Vegetable Center recently signed a memorandum of agreement with the state Government of Odisha, India, to support a research project to improve yields of mungbean (*Vigna radiata*) and urdbean (*Vigna mungo*).

The coastal state has the highest rates of poverty and malnutrition in the country, and among the lowest yields of mungbean and urdbean—two legumes that dominate local cropping systems and diets. The two crops share the same pest and disease problems, and in recent years have been devastated by the spread of mungbean yellow mosaic disease (MYMD).

The project sees the introduction of high-yielding MYMD-resistant lines to enhance farmers' productivity. WorldVeg will also work on improving waterlogging and cold resistance in mungbeans and urdbeans, as well as promoting improved production practices, such as the use of inoculants, line sowing, weeding, and better pest management in the crop and during grain storage.

Good progress has already been made: earlier this year, WorldVeg field staff evaluated 20 mungbean and 14 urdbean lines in four districts across Odisha, and more than half of the lines showed good promise. For more information, contact Ram Nair <ramakrishnan.nair@worldveg.org>.

BITTER GOURD FIELD DAYS

From 21 August to 6 September 2016, seed companies were invited to visit field trials of bitter melon (*Momordica charantia*) at the WorldVeg East and Southeast Asia/Oceania Research and Training Center in Kamphaeng Saen district



of Nakhon Pathom province, Thailand. Fifteen breeders and pathologists from HM Clause visited the plots on the first day of the event. "It was very well arranged and appreciated by our breeders to have this discussion with you during the field visit," wrote the company's R&D Director for Asia, Narendra Kumar Singh, to WorldVeg Cucurbit Breeder Narinder Dhillon. The field event showcased nearly 400 advanced breeding lines belonging to different market segments popular with growers and consumers in different regions of Asia. Lines have been bred for improved yield and fruit quality, and resistance to diseases, such as powdery mildew and *Cercospora* leaf spot, and to viruses, using a broader gene pool derived from the global collection of bitter melon maintained at the WorldVeg genebank. Contact Narinder Dhillon <narinder.dhillon@worldveg.org>.



World Vegetable Center

The World Vegetable Center, an international nonprofit vegetable research and development institute, seeks to alleviate poverty and malnutrition in the developing world through the increased production and consumption of safe, nutritious and health-promoting vegetables. Activities strengthen the entire value chain, from vegetable seed systems and breeding, to market access and nutrition. www.avrdc.org

New Communications Officer Joins APSA



APSA is delighted to announce the appointment of a new Communications Officer, Mr. Steven Layne, who joined the team in early September. Mr. Layne was most recently the Managing Editor of The Phuket News, Features Editor of The Phuket Gazette, as well as host of the Good Morning Andaman morning radio programme of Radio Thailand, Phuket.

A Thai-American who was born and raised in Colorado, USA, Mr Layne has been at home in Central and Southern Thailand for most of his adult life. He holds a B.A. in Communication Arts from Bangkok University International College and has worked as a language instructor, reporter, editor, writer, photographer and DJ. Mr Layne has numerous interests, passions and talents. Among them include sustainability, alternative energy, aquaponics, futsal, the recording arts and the stock exchange of Thailand (SET).

"I'm very excited to take on this exciting new role with APSA. It was a difficult decision to leave behind my comfortable and predictable routine in Phuket, but there is no question about it, world seed and food security is calling everyone on this vulnerable planet to take action. I'm looking forward to meeting all of you and discussing news, developments, opportunities and challenges facing the seed industry. Together, I'm confident we can move forward. I'd like to take this opportunity to invite you to engage with APSA. I will continue to reach out to our members and associates with the aim of forging and strengthening regional and global networks. Don't be shy, say hi or drop an email <steven@apsaseed.org>."

"Finally, if you haven't already, please find and follow APSA on our recently established social media channels, including Facebook, LinkedIn, Twitter and GooglePlus. We are at your service."



TAKII SEED

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Asian Seed Congress 2016 Programme

Sunday 6 November

Programme	Participants	Location
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09:00 - 24:00	APSA Secretariat Meeting Room Open	Secretariat and NOC	Ground Floor : Room 102
13:00 - 17:00	Registration Opens	Delegates, Trade Exhibitors and Accompanying Persons	Registration Area
13:00 - 17:00	APSA EC Meeting	APSA EC Members	Ground Floor : Room 203

Day 1 - Monday 7 November

07:30 - 17:00	APSA Golf Tournament	Players	Sky 72, Ocean Course
09:00 - 17:00	Registration Opens	Delegates, Trade Exhibitors and Accompanying Persons	Registration Area
09:00 - 17:00	Pre-Congress Workshop	Workshop Attendees	Ground Floor : Room 116-117
13:00 - 18:00	Exhibits, Trading and Private Meeting Rooms Open	Delegates	Ground Floor : Exhibition Hall 1
19:00 - 22:00	APSA EC Dinner (by invitation)	APSA EC Members and invited guests	TBA

Day 2 - Tuesday 8 November

09:00 - 17:00	Registration Opens	Delegates	Registration Area
10:00 - 12:00	Inaugural Ceremony	Delegates and Trade Exhibitors	2 nd Floor, Premier Ballroom A & B
13:00 - 18:00	Exhibits, Trading and Private Meeting Rooms Open	Delegates	Ground Floor : Exhibition Hall 1
12:30 - 14:00	APSA Past Presidents' Luncheon (by invitation)	APSA Past Presidents and invited guests	2 nd Floor, Room 203
14:00 - 17:00	Crop Group on Vegetables & Ornamentals	Delegates	Ground Floor : Room 116 - 117
17:15 - 19:15	Activity Group on Seed Technology	Delegates	Ground Floor : Room 113
19:30 - 22:30	Welcome Cocktail Party	Delegates, Trade Exhibitors and Accompanying Persons	Ground Floor : Exhibition Hall 2

Day 3 - Wednesday 9 November

08:30 - 17:00	Registration Opens	Delegates	Registration Area
08:00 - 18:00	Exhibits, Trading and Private Meeting Rooms Open	Delegates	Ground Floor : Exhibition Hall 1
08:30 - 11:30	APSA - National Seed Associations Meeting	Delegates	Ground Floor : Room 116
09:00 - 17:00	Accompanying Person's Tour	Accompanying Persons	Seoul
09:00 - 17:00	Banquet Reservations Open	Delegates	Registration area
11:30 - 12:00	Crop Group on Cover Crops	Delegates	Ground Floor : Room 113
13:00 - 16:00	Activity Group on Intellectual Property Rights & Biodiversity	Delegates	Ground Floor : Room 116 - 117
16:15 - 18:15	Crop Group on Field Crops	Delegates	Ground Floor : Room 113

Day 4 - Thursday 10 November

08:30 - 13:00	Registration Opens	Delegates	Registration area
08:30 - 13:00	Banquet Reservations Open	Delegates	Registration area
08:00 - 12:30	Exhibits, Trading and Private Meeting Rooms Open	Delegates	Ground Floor : Exhibition Hall 1
08:30 - 10:30	Crop Group on Hybrid Rice	Delegates	Ground Floor : Room 113 - 114
09:00 - 12:00	GAM Registrations Open	Delegates	Registration area
10:30 - 12:30	Activity Group on Trade & Marketing	Delegates	Ground Floor : Room 116
12:00 - 14:00	GAM Registrations Open	Delegates	Registration Area
14:30 - 17:30	APSA General Assembly Meeting	APSA Members	2 nd Floor, Premier Ballroom A & B
19:00 - 22:00	Grand Banquet	Delegates, Trade Exhibitors and Accompanying Persons	Ground Floor : Exhibition Hall 2

Day 5 - Friday 11 November

08:00 - 18:00	Post-Congress Tour 1 Day	Delegates	Visit to Nongwoobio, Asia Seed, Koregon, & NH Seed
08:30 - 17:00	APSA EC Meeting	APSA EC Members	2 nd Floor, Room 203

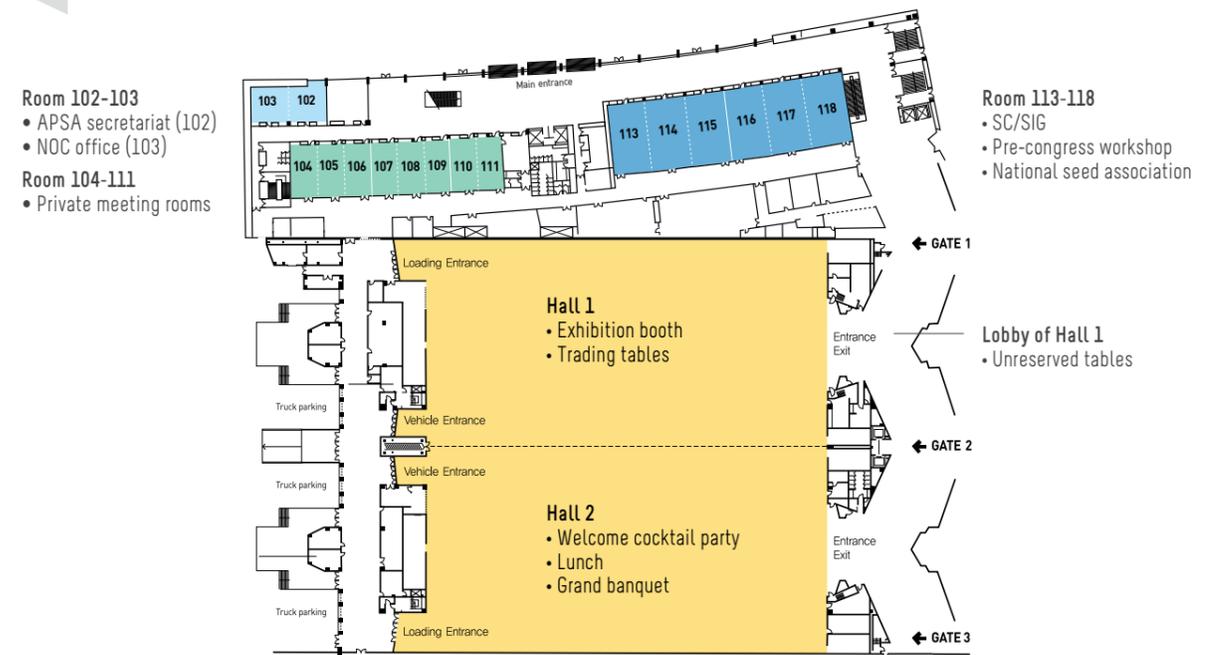
SPECIAL NOTES

1. Trading table and booth areas now have extended times, opening from 13:00 to 18:00 Monday, 11:00 to 18:00 Tuesday, 08:00 to 18:00 Wednesday and 08:00 to 13:00 Thursday.
2. Coffee and tea are served from 08:30 to 17:00, daily.
3. Lunch will be served on 8, 9 and 10 November from 11:30 to 13:30 at Exhibition Hall 2 on the Ground Floor.

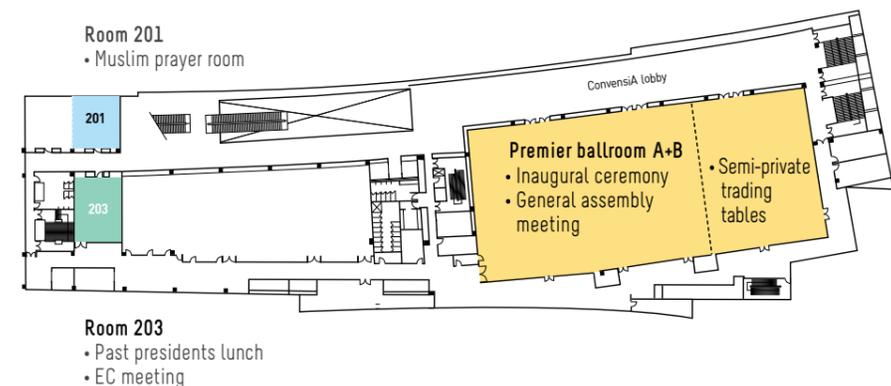
4. All meeting and trading rooms as well as the exhibition area will CLOSE during the Inaugural Ceremony on 8 November, opening at 13:00.
5. All meeting and trading rooms as well as the exhibition area will CLOSE at 13:00 on 10 November for the APSA General Assembly Meeting.
6. Private meeting rooms now have extended times, opening from 09:00 to 18:00 Monday, 11:00 to 18:00 Tuesday, 09:00 to 18:00 Wednesday and 09:00 to 13:00 Thursday.

Asian Seed Congress 2016 Floor Plan

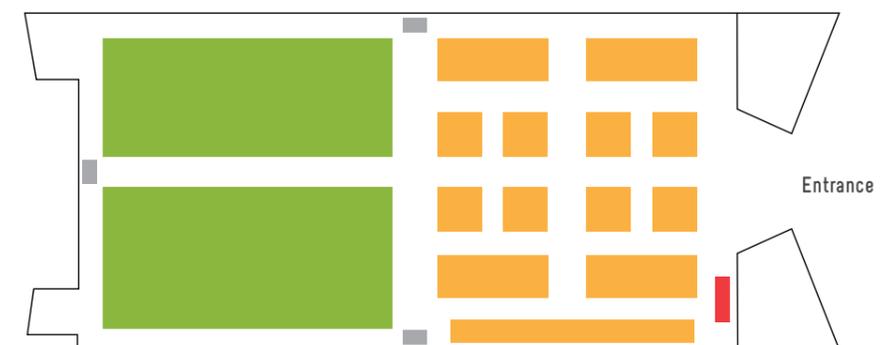
1F



2F



HALL 1



- Trading table (179)
- Exhibition booth (59)
- Snack corner (3)
- Internet center (1)



Photos courtesy of GSI

ACCESS TO SEEDS LAUNCHES 2016 INDEX FOR ASIA

By Ido Verhagen, Executive Director, Access to Seeds Foundation

When the idea was planted for an index that ranks the world's leading seed companies on their efforts towards making quality seeds of improved varieties available to smallholder farmers, the time frame set for achieving the UN's Millennium Development Goals (MDGs) was coming to an end. When the MDGs were replaced by the Sustainable Development Goals (SDGs) in 2015, the first Access to Seeds Index was heading to the printer.

The timing, although unplanned, could not have been better. Doubling the agricultural productivity of small-scale producers, in part through equal access to inputs, is one of the SDG targets to end hunger and achieve food security by 2030. Moreover, the UN

explicitly acknowledges the role of the private sector, as a key provider of capital, jobs, technology and infrastructure, in delivering, or supporting the delivery of, many of these targets.

When one thinks of the private sector in the context of a development agenda, it is multinationals that most often come to mind. Although the 2016 Access to Seeds Index, published in February 2016, is not the first of its kind to examine the ways in which an industry can help solve a global challenge, it is the first to assess regional companies – initially in Eastern Africa – alongside their global peers. And the findings, which serve as a baseline against which future progress can be measured, are revealing.

Revealing Results

The Global Seed Index assesses leading field crop and vegetable seed companies in four regions identified as having a food security challenge, smallholder farmer presence and agricultural potential. These are Latin America, Western Africa, Eastern Africa, and South and Southeast Asia. Companies are assessed on their activities in all four regions, based on the six dimensions of 'access to seeds' identified by stakeholders: availability, affordability, suitability, capability, profitability and autonomy. Indicators expressing what stakeholders expect from seed companies on each of these dimensions are grouped into seven measurement areas. Each measurement area is composed of indicators that assess commitment, performance, transparency and innovation. The Regional Index, meanwhile, includes multinationals and seed companies originating in the region. Both the Global and Regional Indexes seek to identify leadership and good practices, providing an evidence base for the discussion on where and how the seed industry can do more. However, it is the findings of the Regional Index that are perhaps most surprising. The leading position is occupied by Thailand-based East-West Seed, followed by companies originating in the region. These companies often go further than their multinational counterparts to ensure smallholders

can access their products, notably in the development of innovative marketing and sales strategies. As an example, Victoria Seeds uses local tuk tuks (motorised three-wheeler vehicles) as mobile seed shops to reach remote villages. Regional companies also outperform their global peers in the conservation and use of genetic diversity, for instance by partnering with seed banks and research institutes.



FARM HANNONG

Farm Hungnong



Seed Business Division

HANNONG SEED is the largest agricultural vegetable seed company in Korea, leading the industry for over fifty years. We have maximized our business potential and combined it with next-generation technology growth engines that have made us world-wide leaders in the agricultural industry. We will continue concentrating our strengths on developing better products and services to enhance competitiveness of Korean agriculture. Furthermore, we are striving for the goals of sustainable agriculture and rural communities. HANNONG SEED, immediately connecting with farmers, will lead the globalization of Korean agriculture and contribute to the of a healthy and prosperous 21st- century life.

Since 2012, HANNONG SEED has initiated a new venture with Monsanto Korea, previously known as Hungnong seed. We have turned out the most advanced vegetable seed company in Korea. As a new leader of the seed industry in Korea, we promise to serve the industry and farmers with high-quality vegetable seeds that can increase the farm productivity as well as consumer health. We are market leaders in plant breeding, production, processing, marketing and the sales of hybrid vegetable in 550 varieties of 23 different crops with diverse brand strategies.

HUNGNONG SEED

Hungnong seed was founded in 1956. Hungnong has been the leading Korean vegetable seed breeding company and has a heritage of innovation and varietal resources accumulated over 60 years. Hungnong has been a pioneer company and making tremendous contribution for 70 years for all over the world. Through the merger with Farm Hannong Vegetable Seed Company Inc, Hungnong Seed has become the No.1 valued brand in Korea seed market. Hungnong seed is specialized in Brassica, Solanum and Cucurbit. Through their highly advanced breeding work, Hungnong is one of the major centres for vegetable seed technology within industry, creating new methods of seed enhancement and treatments to further improve seed quality and performance.

HANNONG SEED

In 1981, Hannong seed was established and has been since dedicated to improving its global supply of quality agricultural products to professional vegetable growers, and as one of the largest vegetable seed businesses, it is daily placed to continue to serve its worldwide client base through high-value technology. Hannong seed is specialized in Cucurbit, Ulicaceae and leafy vegetable. We are leading the industry in the conservation of genetic resources, and are combining bio-engineering with the art of breeding. Additionally, our possession of a wide range of seed treatment technologies has expanded our business from vegetable to field crops.



Photo by John Clewley

Regional Index for Asia

On the basis of these findings, the possibility of broadening the scope of the Regional Index to South and Southeast Asia, which has the largest number of smallholder farmers but also the highest prevalence of hunger, is currently being explored.

Consultations with Asian farmer organisations are underway, the results of which will be presented at the Asian Seed Congress in South Korea from November 7-11. Further dialogue with stakeholders, as well as a feasibility study, will inform the evaluation necessary to determine the country, company and crop scope of such an index. Initial research has already uncovered some exemplary practices by global companies. Bayer, for example, is partnering with other organisations to provide smallholder education programmes and advisory services in a number of Asian countries. Other companies, such as East-West Seed, are breeding local crops tailored to smallholders' needs. A Regional

Index for Asia would likely identify further examples of what companies, both global and regional, are doing to target smallholder farmers and where there are opportunities to improve.

The exploratory work being carried out for the next Index, which is scheduled for release in 2018, is taking place in parallel with a thorough review of the first Index. An independent Expert Review Committee met in June to re-examine the current methodology and discuss how this can evolve to better accommodate future iterations. Also ongoing are discussions on the Index's findings and their implications for the role of the seed industry in advancing the SDGs. Over the year, the Access to Seeds team has attended farmers meetings in Africa and Asia, and spoken to industries and other stakeholders at events organised by FAO, IFPRI and the African Seed Trade Association, among others.

Filling Critical Gaps

The Access to Seeds Index focuses on the private sector, but it is clear that smallholder development cannot be achieved by the seed industry alone. Market conditions are often a limiting factor. The industry, through its trade associations, could join forces with governments to create an enabling environment in which markets can flourish. At the same time, a better understanding of the industry's current activities

could help governments direct limited development resources. The Access to Seeds Index hopes to fill some of these critical information gaps.

For more information about the Access to Seeds Index, including the 2016 Index Report and rankings, see www.accesstoseeds.org.

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Corrections

In volume 22, issue no. 4 of Asian Seed magazine, the following error was made: Page 11, The ISTA 2017 Congress was wrongly identified as The ISTA 2017 Annual Meeting that would take place 19-22 June, 2016. In fact, the ISTA 2017 Congress will take place 19-22 June, 2017.

Protecting Plant Profits from IP Infringement

Two years ago, the Anti-Infringement Bureau (AIB) joined APSA as an associate member. At the last General Assembly Meeting in Goa, Casper van Kempen, AIB's Managing Director, was elected to be a member of APSA's Executive Committee. Here, Asia Seed speaks with Mr. van Kempen about AIB and its activities.



Photo by USDA



What is AIB and what is its mission?

The full name is the Anti-Infringement Bureau for IP Rights on Plant Material.

AIB started its activities in 2010, created by a consortium of leading vegetable seed companies, to prevent and discourage infringements of intellectual property rights. In this way, AIB tries to ensure an equal playing field for all operators in the vegetable chain.

What are intellectual property (IP) rights in the vegetable seed industry?

The main types of IP rights in our sector are:

- Plant Variety Protection (PVP). When a breeding company obtains a PVP title for a new variety, it disallows others to reproduce said variety without explicit authorisation of the breeder. This means, for instance, that it is not permissible to reproduce that PVP variety from seeds or cuttings. An exception applies to farmers in countries that have the so-called Farmers Privilege in their law, which allows farmers to use their farm saved seeds on their own holdings for propagation purposes.

- Trademarks. This protects the breeder against fake packaging or misuse of the company name.
- Patents. This is a relatively recent phenomenon, and there are presently very few that have been issued for vegetables.

Why are IP rights important for the vegetable seed industry?

IP rights are crucial for the seed industry as they provide a basis for ensuring returns on the high risk and upfront investments that are needed to create a new plant variety. Unfortunately, infringements of IP rights are as old as IPs themselves.

Why is the AIB needed?

Over the past years, the vegetable seed sector has seen an increase in the illegal reproduction and distribution of its products, resulting in a surge in the number of unauthorised end products in the market. As is the case with piracy and counterfeiting in other sectors, the actual damage to the industry is difficult to measure. However, it is a significant number, estimated to be tens of millions

of Euros per year and growing rapidly. This affects the industry in many ways, with major exporting countries suffering most from infringement, which has particularly impacted the tomato and lettuce trade.

What exactly are the consequences of IP infringement?

There are several. IP rights are designed to encourage investment into new inventions, in this case vegetable plant varieties, and to reward the breeder for that investment. When IP rights are not protected, the readiness to invest in new, strong varieties decreases, resulting in lower growth rates and serious damage to the sector's innovation and overall development.

Moreover, once a product is reproduced illegally and royalties are foregone, the whole vegetable value chain is affected. Growers, traders and wholesales alike suffer from unequal competition, as the prices of the illegally grown products tend to be lower and therefore more difficult to compete with.



Photo by USDA



Photo by Florian Steiner



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Photo by Jon Sullivan

What are the major areas of infringement in respects to the vegetable industry?

This differs for each geographical region. In Asia, a big problem is the misappropriation of parent lines, in legal terms qualified as 'trade secret' theft. AIB receives numerous reports from breeders signaling that copies of their hybrids are being sold by unauthorised third parties.

In Europe and the Mediterranean Basin, the propagation of vegetable hybrid crops, which emerged about 10 years ago, has developed into a very large and expanding trade, particularly in Southern Europe. For instance, the development of grafting techniques has spurred a huge increase in vegetative propagation of the tomato plant. It is estimated that vegetative propagation is utilised in about 20 per cent of the total tomato acreage in Spain and Italy, the highest percentage of which is for cherry tomatoes. There have also been a number of documented cases of vegetative propagation of melons, watermelons and eggplants. However, not all vegetative propagation is illegal as not all varieties are PVP-protected, so the primary concern is vegetative propagation of protected varieties.

A major infringement activity found worldwide is the illegal multiplication of seeds of PVP-protected open-pollinated varieties, in particular, lettuce and beans. This is done by seed producers, plant raisers and large specialist growers. It is estimated that for certain lettuce types, infringement exceeds 35%. Many illegally reproduced seeds are marketed and sold under old generic variety names, so AIB keeps a close eye on the market to obtain samples of illegally-copied seeds. In Eastern Europe and Central Asia,

the illegal F2 (hybrid seed) production of protected hybrid onions is very substantial. The problem here is that in many cases the F2 seed is physically very similar to the F1 variety, making it difficult to detect.

Are there any other types of infringements AIB is addressing?

Yes, counterfeit and variety fraud are also recurrent. Counterfeit seeds are sold in fake package, and the seeds in these packages are often not the varieties as indicated on the label. They are instead inferior types of seeds of unknown varieties. The growers who purchase them in good faith are often victim to crop failure.

An example of fraud is when growers order (and pay for) young plants of a certain variety, but receive a different and most often inferior variety. This problem is recurrent in rootstock, and sometimes leads to catastrophic consequences for growers.

What have been AIB's actions against infringements?

AIB files complaints with enforcement agencies regarding any observed and verified infringements after consultation with the rights holder concerned. This action has been taken many times in recent years in the main affected countries, where very good relationships have been developed with enforcement agencies.

In recent years, AIB has raised awareness among plant raisers and growers by filing over 40 legal complaints with authorities. In most cases, the enforcement agencies fully cooperated and made inspections of the suspected companies. As IP piracy very often

has a linkage to other illegalities like phytosanitary and seed law offenses, tax evasion, fraud, and unfair competition, many enforcement agencies are welcoming AIB's denunciations. In several cases, the criminal investigations found proof of organised crime, whereby the illegal operations involved a network of companies active in different countries and continents.

Profits from piracy are high. The financial benefits reaped by lettuce growers in Europe, who buy the illegal seed at very low prices, amount to a very significant US\$ 400/acre per production cycle. For the Southern part of Italy alone, authorities estimate that the value of undeclared harvested crop from illegally grown cherry tomato plants exceeds US\$ 500 million per annum.

What are the prospects of AIB's actions?

We are confident that we have curbed the growth of IP infringement in countries that have more experience enforcing IP laws, especially in Europe where we have had a positive impact in reducing the scale of illegal vegetative propagation of tomatoes. The actions we triggered in cooperation with enforcement agencies have at least made any potential infringer aware of the risks, and therefore, much more careful. This seems to have at least contained the problem.

In emerging countries with rapidly growing production, infringement is on the rise. This can be partly explained by a shift towards higher-value genetics. Also, the general level of technical skills is rising, opening the door to vegetative propagation. This is the reason that AIB is expanding its activities in these countries. 🍅

See the Seed!

Dr. Yong Pyo Lim, Director of the Golden Seed Project (GSP) Vegetable Seed Center and Professor in the Department of Horticulture at Chungnam National University, Korea



There is life in the seed. One seed comprises genes, DNA and nuclei, which make a complete plant with beautiful flowers. The plant then produces more seeds enabling more life. It's incredible, isn't it?

My tiny dream about seeds can be traced back to my school days. I have always admired the miraculous life cycles of the plants around me; they encouraged me to become an agricultural scientist.

My long journey began when I entered the Department of Horticulture, Seoul National University, in 1975. After graduating, I started my research career at AVRDC's branch, the Horticultural Experimental Station (now the National Institute of Horticultural and Herbal Science). There, I learnt a lot about agricultural sciences and, in particular, advanced cruciferous breeding techniques.

I pursued further research on genetics and breeding at Seoul National University, then I joined Yale University after completing my Ph.D. thesis at the University of Rhode Island, USA. At Yale, I researched anthocyanin biosynthesis in maize.

In 1992, as a professor at the Department of Horticulture, Chungnam National University, I started to research the

genomics of Chinese cabbage in coordination with genetics and breeding studies; I chose the Chinese cabbage as it is the second most valuable crop and has a long agricultural history in Korea.

In 1994, following training on setting up a BAC library from Dr. Melvin I. Simon at Caltech, California, I was inspired to create, for the first time, a BAC library for Chinese cabbage. I also developed several molecular markers to untie the secrets of the tiniest seeds. In 2003, I set up the Multinational Brassica Genomics Project (MBGP) with collaborating scientists from Australia, Canada, China, UK and the USA. I contributed to the MBGP during the time the whole genome was being sequenced.

In 2011, the draft genome of Brassica rapa was published in Nature Genetics with the help of Next Generation Sequencing technologies, and it was introduced as a model genome sequence for the genus Brassica. I have since developed a huge number of SNP markers for genome-wide association mapping.

I have developed a data bank of Brassica germplasm, breeding populations, molecular markers, genetic maps, genomic and transcriptomic sequences, genes, and how they all function. These materials are computationally accessible through

our database. Using the data, we now understand the cross-talk between the genes, and the relationship between the inbred lines which leads to absolute marker assisted selection for breeding.

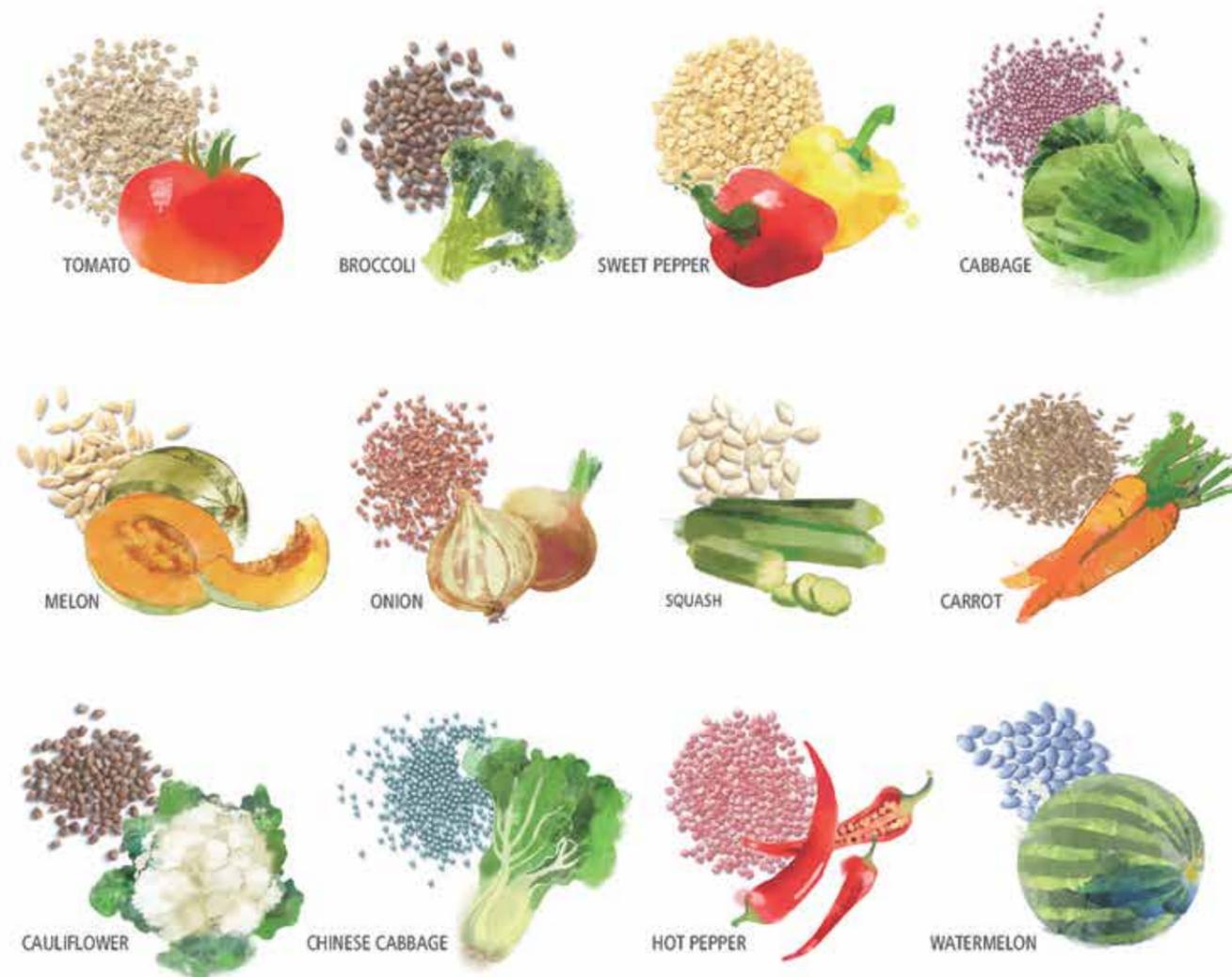
Moreover, the availability of various species, their genomic sequences and genetic variations, will help in the study of their relationships with each important Brassica trait. It has greatly contributed to the development of the Brassica breeding industry and will improve crossbreeding in the near future.

As the data bank grew, I started to think about how this valuable germplasm could apply to future agriculture. So I suggested the term "human-friendly agriculture", which is an agricultural model that includes breeding, cultivation, and food supply information to support personalised nutritional supplements applicable to all people based on individual human genomic data. This system should include an optimised breeding system for personalised cultivars that can contain high-value nutrition, which will be required by healthy and/or diseased humans. Robotic plant factories and automated precision farming systems may be able to produce crops with highly concentrated targeted nutrition. I believe that "human-friendly agriculture" will be a new paradigm for next generation agriculture.

When I look back at my career, I have published many research articles, authored technical books on Brassica genetics and genomics, and developed the three cultivars of Brassica napus. But I believe that my most valuable achievement is that I have collected over 4,000 Brassica germplasms from around the world, supposedly the largest collection of Brassica germplasm in existence. I have been able to support scientists and companies worldwide with germplasm from the collection, assisting in the improvement of Brassica varieties. As director of the Golden Seed Project (GSP) Vegetable Seed Center, I try to assist in the facilitation of the vegetable seed industry in South Korea. I am also honoured to serve as the President of the Korean Society of Horticulture Science for 2017.

My childhood dream about the life of tiny seeds inspired me to see how improving agriculture could improve human health. And as the journey goes on from yield-oriented breeding to high nutrient concentrated farming, I think we can expect genomics and biotechnology to contribute to human-friendly agriculture in the near future. 🌱

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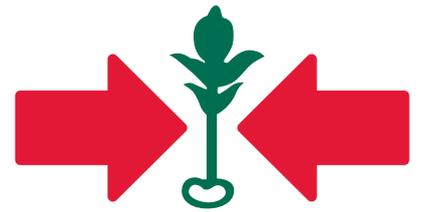
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